Texas Highways

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concrete pipe installed by

imperfect trench method

Charles H. Reasonover, Senior Resident Engineer
District 10

A contract for the relocation of U. S. 69 in Cherokee County between Tyler and Jacksonville, Texas, was awarded jointly to Adams Brothers Construction Company, Athens, Texas, and Dew Construction Company, Inc., Tyler, Texas, in July 1960.

This project will replace a section of U. S. 69 in what is locally known as the "Loves Lookout" area north of Jacksonville, with the new location moving east of the existing highway, and through very rough terrain for which this area is noted. The Cotton Belt Railroad, which parallels the present highway to the west, prohibited relocating in this direction.

The new location, near a divide, required the use of numerous small structures. These structures had to be placed under embankments exceeding the maximum allowable for standard concrete pipe culverts. The problem, then, was to design adequate struc-

General view of U.S. 69 relocation.

View of trench excavated over 48-inch pipe to one foot above pipe.

with Type B bedding, which would otherwise be required.

The imperfect trench method of construction was selected for ten pipe-culvert installations on this project. This was recommended because of the economy that would result, and the knowledge that very good materials for the structure foundation were available.

The specifications for the imperfect trench are covered by a special provision to Item 104 and call for the pipe to be installed upon the type bedding indicated for each structure. The pipe is then backfilled and compacted at least twelve feet each side of the pipe. After the embankment has been constructed to an elevation equal to the outside diameter of the pipe plus one foot, a trench is dug

tures to accommodate the resulting loads.

After determining the height of fill and size of structure required at each location, a study was made using the design available. This included the imperfect trench method. We were assisted in this study by the Bridge Division of the Highway Department in Austin.

The size of pipe culvert required through this section varied from a 24-inch opening to a 54-inch opening, with a maximum fill of 48.5 feet. which occurred over a 48-inch culvert 308 feet long.

R. C. Pipe Class III, with either Type B or Type C bedding (depending on the design load) was required, using the imperfect trench method. Cost of excavating and backfilling the trench required would cost much less than the cost of R. C. Pipe Class IV,

Sawdust is dumped into prepared trench.

The sawdust is spread to proper elevation.

The trench is backfilled with sawdust and graded prior to receiving selected soil material.

in the fill directly over the pipe. The width of trench is equal to the outside diameter of the pipe, and the depth is carried to within one foot above the pipe, with care taken to keep the sides of the trench as vertical as possible. The lower one-third of the trench is then filled with straw, hay, cornstalks, leaves, or sawdust, and then completely filled with highly compressible soil material. Normal embankment operations are then used to bring the fill to finished elevation.

Trenches for this project are first staked to insure that the excavation will be directly over the pipe and that the fill is to the proper elevation. A dragline is used to make the excava-

Next, the trench is backfilled with selected soil after sawdust has been placed.

tion, and the size of drag-bucket varies to fit the required trench width. Hand methods are used to trim the edges, making them as vertical as possible. Sawdust is hauled from a source nearby and placed in the bottom of the trench. The trench is then filled with excavated loose material, or a better material is hauled from other roadway excavation if material excavated has many large clods.

Eight of the imperfect trench installations have been completed on this project. Although the fill sections have not been completed, heavy earth-moving equipment has been over the structures, and no signs of failure or settlement have been found.

These structures will continue to be inspected so that we may determine the adequacy of this type of design for future projects in District 10.

Note loose material placed on top of the sawdust.

A Test Section on F.M. 1234 in East City Limits of Abilene, Texas

rubberized asphalt seal coat

N. A. Billingsley Jr.
District 8

On May 24, 1960, a research project was begun in District 8 as a result of the combined cooperation of Cosden Refinery, the Texas Transportation Institute, Austin office, and District 8 personnel. The project consisted of a single application of asphalt surface treatment being applied to an existing 22-foot asphalt surface as a seal coat. Varying quantities of a rubberized asphalt and aggregates were used on this 1.84-mile section of highway.

The purpose of the research project was to observe behavior of the rubberized asphaltic material as compared to ordinary oil asphalt in construction operations as well as its effectiveness and durability as an asphalt cement in a seal coat. Therefore, one section of standard OA-135 asphalt was used and covered with aggregate in the same manner as the section using the rubberized asphalt, in order that some correlation might be observed in the behavior of the two types of asphalts.

The asphalt cement consisted of an intimate blend of refined oil asphalt and a suitable polymeric material which gave a product meeting the requirements of Special Specification, "Polymerized Asphalt Cement—Grade 120-150." (See next page.)

Six per cent Rubarite (butadiene-styrene) was used in standard OA-135 asphalt from Cosden Refinery, Big Spring, Texas, to meet the above specification.

The following rates of application were placed:

Section	*Asphalt Gal/SY*
1	0.306
2	0.250
3	0.370
4	0.302
5	0.347
6	0.352
7	0.294

Sections 1 through 6 were placed with the rubberized asphalt and Section 7 was placed with ordinary oil asphalt. Grade 5 aggregate was placed on a 1:78 ratio.

Regular OA-135 was applied on the right lane and rubberized asphalt on the left. The road has been under traffic one day here. Notice discoloration of cover stone in the right lane, indicating that bleeding could become a problem. (This later proved true, for maintenance-curing aggregate was required on this section.)

Observations to date are:

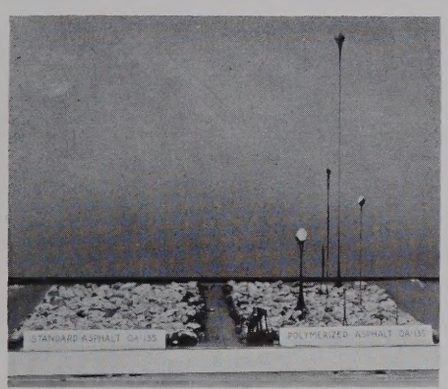
(1) The polymerized asphalt has minimized bleeding on all sections and rates of application. The section containing the polymerized asphalt applied at 0.37 gallons per square yard has required almost no maintenance. This observation would allow the use of heavier asphalt application resulting in a better degree of crack sealing.

(2) The polymerized asphalt indicated a high degree of toughness.

The project, which carries approximately 2,000 vehicles per day, was subjected to heavy truck haul to a nearby highway project immediately after being placed. Had regular grade OA-135 asphalt been used, it would have probably required extensive maintenance applications throughout.

A rock is lifted from the surface of the rubberized asphalt to show its ductility and toughness.

The retention of aggregate originally applied has been very good, and maintenance-curing aggregate has not been required.



The difference in ductility and toughness between regular OA-135 and rubberized asphalt is shown here. The photograph was taken with a plate holding the sample surfaces upside down so that the cover stone could fall from the surface. (To avoid erroneous conclusions, the following explanation is given: The aggregate formed long strings of asphalt from the surface containing the rubberized asphalt before the aggregate dropped off; whereas, only very short strings of asphalt formed from the standard asphalt before the cover stone dropped. The section with the standard asphalt actually lost more cover stone, even though the photograph indicates the opposite.)

TEXAS HIGHWAY DEPARTMENT

SPECIAL SPECIFICATION

POLYMERIZED ASPHALT CEMENT

GRADE 120-150

1. DESCRIPTION: This item shall consist of an intimate blend of refined oil asphalt and suitable polymeric material which will give a product meeting the following specific requirements.

2. MATERIALS: The original asphalt before blending shall meet all requirements of one of the grades of OA asphalts of the Texas Highway Department Standard Specification, Item 350 "Asphalts, Oils and Emulsions". In addition the original asphalt shall be subjected to the "Thin Film Test" in accordance with AASHO Test Designation T 179-57, after which the residue shall have a minimum ductility of 100 cm. at 77°F. when tested in accordance with AASHO Test Designation T 51-44.

The Polymerized Asphalt shall be essentially free from water and not foam when heated to 350°F.

3. SPECIFIC REQUIREMENTS: When tested according to the latest applicable AASHO Test Procedures except where otherwise specified, the finished polymerized asphalt shall meet the following specifications.

Penetration at 77°F., 100 grams, 5 sec.	120-150
Penetration at 32°F., 200 grams, 60 sec.	30 Min.
Flash Point C. O. C., °F.	450 Min.
Softening Point, R. & B., °F.	115 Min.
Ductility, 77°F., 5 cm./min., cm.	100 Min.
Ductility, 39.2°F., 5 cm./min., cm.	50 Min.
Effect of Heat on 1/8" Film at 325°F., 5 hrs.	
Loss in weight, %	0.75 Max.
Ductility of Residue, 77°F., 5 cm./min., cm.	100 Min.
Penetration of Residue, 77°F., 100 gms., 5 sec., % of original	50 Min.
Toughness (THD Special Procedures for Polymerized Asphalts) inch-pounds	60 Min.

4. MEASUREMENT: The Polymerized Asphalt material will be measured by the ton of two thousand pounds (2000 lbs.) at the point of delivery specified.

5. PAYMENT: Materials furnished as prescribed for this item and measured as provided under "Measurement" will be paid for at the unit price bid for "Polymerized Asphalt" which price shall be full compensation for furnishing the material to the specified point of delivery.

D-8 Tentative
11-59

first of its kind

Negotiator's Manual

The right of way negotiator is that employee of the Texas Highway Department who sits down in the parlor with the Joneses to discuss the Department's offer for their property. He is a salesman whose words and actions determine whether or not Interstate Highway miles in Texas are constructed upon land sold to the Department in good will.

The importance of the negotiator to the successful acquisition of right of way is underscored for him and others to read in a new reference handbook issued by the Right of Way Division in early December. Titled *Manual for Negotiators,* the 99-page book is the first of its kind in the nation to be issued by a highway department right of way division, said A. H. Christian, State Right of Way Engineer.

The pocket-proportioned *Manual* was written by a two-man survey team. George T. Jefferson, District Right of Way Engineer of District 2, and Alton W. Tieken, Right of Way

George T. Jefferson, District Right of Way Engineer in Fort Worth, (right), traveled the Districts to make the survey upon which the "Manual for Negotiators," is based. Here he discusses property boundaries with Fowler Faubion, Senior Right of Way Agent in District 2.

Appraiser of Division 15, visited 21 districts, and the free expressions of opinion they heard in answer to survey questions form the basis of the text.

The *Manual* has been distributed to all right of way personnel throughout the state. It also has been dispatched to Bureau of Public Roads offices in Texas and Washington, to other highway departments throughout the nation, and to the office of the Attorney General of Texas.

The right of way negotiator is described in the *Manual* as an individual who is expected to comprehend each phase of processing through which a right of way parcel has been carried before it reaches him at the end of the line. Explanation of such preparations for negotiations, including the work of engineer, appraiser, and legal counsel, makes up the first section of the volume. Though technical, these details are presented in a readable manner, easily understood. "The negotiator who does not understand cannot explain," says the book's introduction.

Christian said the negotiator in his direct public contact must know about all factors in the Department's acquisition of land for Interstate right of way. "Usually an owner anticipates the meeting with the Highway Department's representative from the time he first learns the new Interstate Highway will require some or all of his property. The questions he may ask at first meeting with a negotiator can cover a wide range for which answers must be authoritative," the Right of Way Engineer stated. On the pages of the *Manual* is the information from which negotiators in every district in the state can learn the answers. Inquiries about the manner in which the real estate was appraised,

A. W. Tieken, Right of Way Appraiser in D-15, was the other member of the traveling survey team which produced the "Manual." Here he dictates a mailing list to Charlyne McDaniel, Stenographer, (left). Copies have been sent to all Districts and to highway departments in other states.

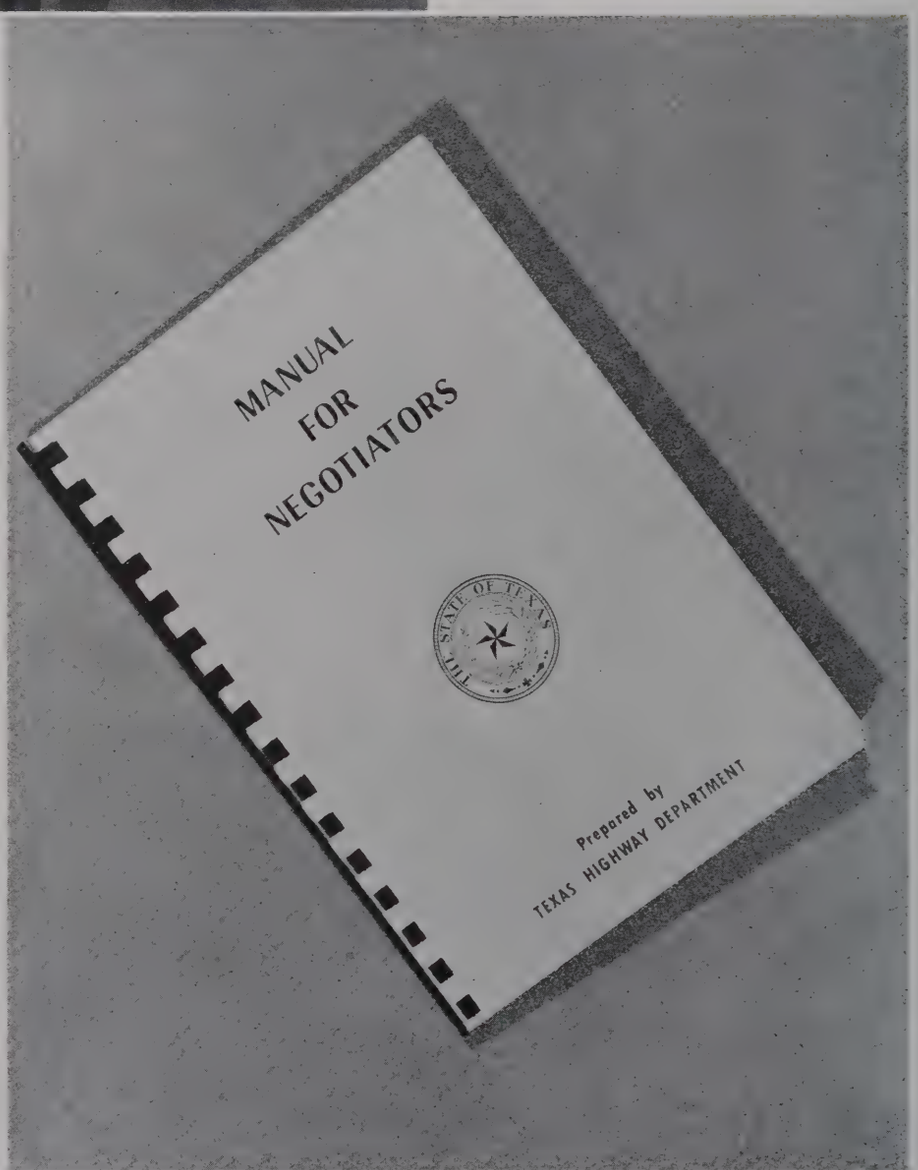
Right of Way Engineer A. H. Christian (seated) discusses the pace-making publication with W. Ben Averyt, Right of Way Administrative Engineer. The Texas Highway Department is the first state highway agency to publish such a work aid for right of way personnel.

how the legal papers will be drawn, design of the proposed highway, are but a few subjects he will be called upon to interpret.

The following excerpts from the *Manual* comment on the work of the negotiator: "He has been chosen for his ability to get along with people, to talk their language—so to speak—to understand and explain the necessity for, and the methods by which their property will be acquired for construction of a facility of great public benefit."

"The initial contact by the negotiator is a culmination and is the climactic point to which all previous right of way operations have been pointed."

"It is highly improbable that any two discussions of real estate transactions will follow the same pattern —at least not in this democratic country."



The 99-page, pocket-sized book includes such background topics as Highway Department organization and policy, design and construction of highways, and the work of engineer, appraiser, and legal counselor. All this the negotiator may draw upon in his explanation of the Department's purchase offer to a landowner.

New Division Head Named

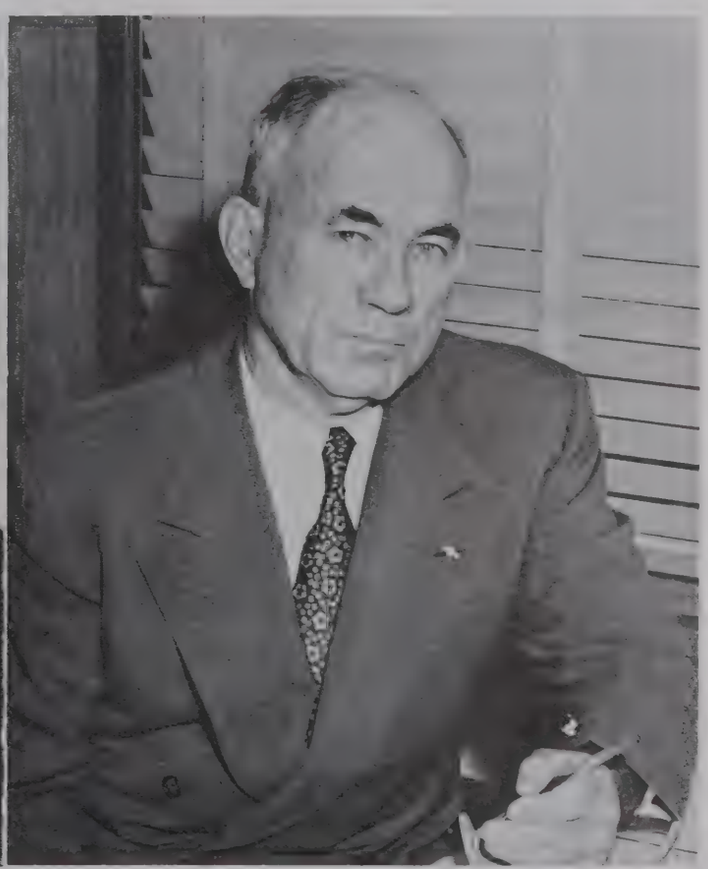
The retirement of Robert E. Lindsey, Director of the Insurance Division, has been announced by State Highway Engineer D. C. Greer, effective February 28.

Replacing Lindsey as Director will be Richard Schieffer, presently Assistant Director of D-20.

Lindsey has almost 24 years of service with the Highway Department, all of it with D-20. He started with the Department in 1937 as a Safety Instructor-Investigator, and was Assistant Director of Insurance Division for twelve years before being named Director in 1953.

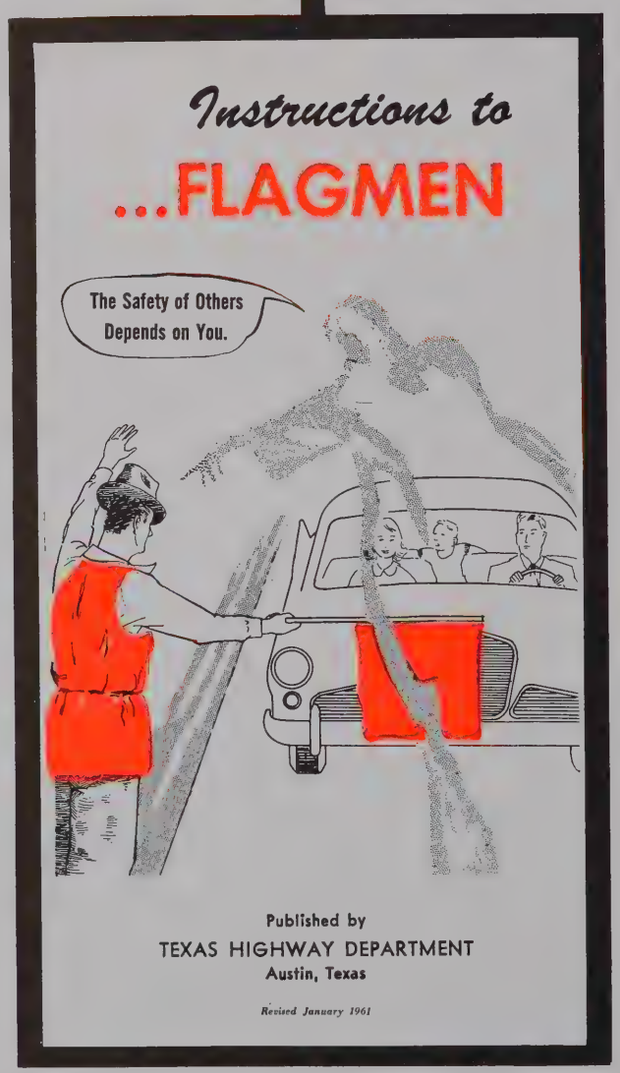
Schieffer comes to the top Insurance Division post after seven years as Assistant Director. He has been with Insurance Division for sixteen years, and with the Department almost 30 years. He worked in Aid Division for twelve years before transferring to D-20.

Richard Schieffer



Robert E. Lindsey

red safety symbol



The man in the red vest is now a symbol of safety to motorists on Texas highways.

Flagmen directing traffic at highway maintenance and construction projects now wear bright red fluorescent vests and use flags of similar color to make them more easily visible and recognizable both day and night.

Adoption of the eye-catching apparel was announced in an administrative order issued by D. C. Greer, State Highway Engineer, who termed the action ". . . a further step toward added safety and convenience in the movement of traffic through highway maintenance and construction operations."

Highway Department maintenance employees assigned as flagmen will be wearing the nylon vests by mid-February and Greer said that beginning with the February contract letting, specifications for all highway construction projects would require that flagging be done with the use of the special vests and flags. Red flags have been used in the past but the fluorescent coloring is a new requirement.

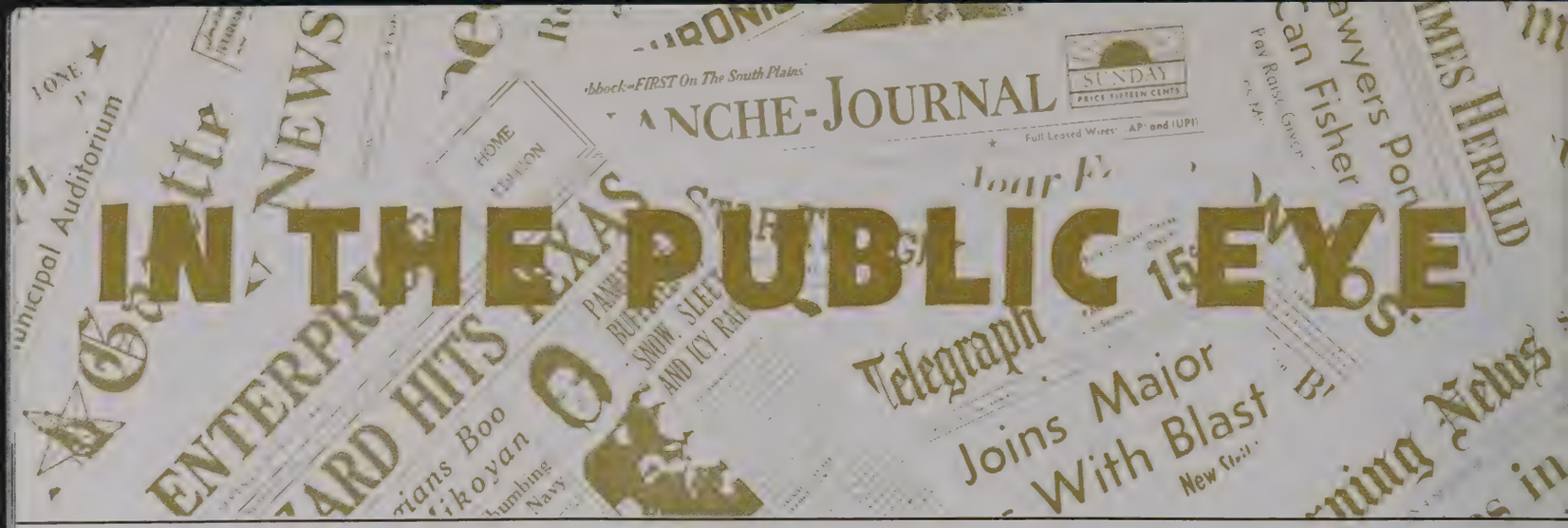
J. A. Waller, Chief Engineer of Maintenance Operations, said the pamphlet "Instructions to Flagmen" has been revised to include use of the new vests. He called the post of flagman "one of the most responsible jobs in our highway operations" and said flagmen fulfill two important functions:

They are guardians of the safety of motorists approaching and passing through areas under construction or repair, as well as for the employees working on the highway.

They are front-line public relations men for the Highway Department.

"It is extremely important that flagmen follow the prescribed rules for safety as outlined in the revised pamphlet," Waller said. "Good flagging procedure can save injuries—or even lives—of Highway Department employees or highway travelers."

Waller stressed the need for a neat personal appearance and a courteous manner for flagmen. "The only contact most drivers have with the Highway Department is with the flagmen —and it is essential that this contact should leave a favorable impression with the public," Waller said. "The public will invariably have a greater tendency to judge the construction or repair job from the impression of and treatment received from the flagman, than from the actual work being performed. Flagmen are in an excellent position to promote good will for our entire organization and they should be ever conscious of these responsibilities when dealing with the traveling public."



LITTLE HOPE

Naples Monitor, editorially foreseeing that—"There is little hope that Naples will get in 1961 the improved highway it wants to Daingerfield.

"The immediate delay apparently is in preparing deeds for rights-of-way.

"However, Naples early this year asked for and got a hearing for a group of its citizens before the State Highway Commission to request early action on Highway 338 improvements."

SEEING RED

Orange Leader, commending use of fluorescent red vests by flagmen at construction and maintenance sites—"These things are a big help, and we are very grateful to the Texas Highway Department for its varied efforts to lend a hand."

BRUSHING UP

Paris News, telling of first-aid training activity—"Twenty-seven Texas Highway Department employees completed a two-day refresher course for first aid instructors last week at the District 1 headquarters here.

"Burnam Black of Waco, senior safety instructor for the Texas Highway Department, assisted in conducting the course."

NAMESAKES

Abilene Reporter-News, announcing—"City Commissioners hope to name two major highways which run through Abilene after local men whom the commission feels has made considerable contributions to local and area growth.

"Commissioner Ray Grisham . . . suggested that portion of Interstate 20 which is inside the city limits be named Roberts Freeway after District Eight Highway Engineer Jake Roberts. . . ."

THE BREAKING POINT

Houston Press, calling the leveling off of Interstate highway construction costs "A Break for Taxpayers"—"But the biggest gain registered against the deadly inflationary spiral was achieved through the use of more productive machinery and techniques. What happened here, in short, was a strong gain in miles of highway produced for the man-hours contributed—enough to halt the historic rise in overall costs."

FAVORABLE REPORTS

Vernon Daily Record, datelined Quanah—"W. V. (Vance) Favor, who has become known as one of the best maintenance foremen in the state, will close a 35-year career with the Texas Highway Department when he retires on March 1.

"H. W. Edmondson, a native of Quanah, who has been with the department for 25 years, has been named to succeed Favor."

Quanah Tribune-Chief, in a feature on Favor—"Favor has been a part of an organization that is noted all over the United States for being probably the tops in highway maintenance and construction.

" 'If I had my life to live over, I would still work for the Texas Highway Department,' Vance said. 'I have enjoyed my work very much.' "

Gaines County News (Seagraves), noting honors for an employee with 24 years service—"An award for showing the greatest improvement in county maintenance throughout the past year was presented recently to Weaver Patterson, maintenance foreman for the Texas Highway Department in Gaines County.

"Patterson was the winner of a contest in the 17-county area of District Five.

"O. L. Crain, district engineer, presented the award to Patterson, as well as one to Cornelius McMahan, Sr., maintenance foreman of Bailey County."

THE BRIGHT HORIZON

Paris News, forecasting a bright construction picture for 1961—"These new and improved highways, in turn, will contribute in a major way to the economic progress and well-being of the areas they serve, as well as to all the people who drive motor vehicles over them.

"New highways are an unfailing sign of progress. This type of construction is a solid bulwark in the foundation of good business."

DON'T FENCE THEM IN

Houston Press, plugging for an extension of law limiting billboards on the interstate highway system, due to expire in June—"These highways, 41,000 miles long and costing $40 billion, run through some of the most beautiful scenery in the world. It will be a shame and a permanent loss to the country if they are permitted to become monotonous alleys, fenced in by advertising signs."

SO FAR

Dallas Morning News, foreseeing a

tightening of boat laws—"Boaters are lucky so far in that there are very few laws regulating their activities. And the few laws we have are generally not enforced, yet."

WITH A LITTLE BIT

Yoakum Herald-Times, on advertising—"Advertising Texas tourist attractions would pay in a big way, Travel and Information Bureau Director Tom Taylor . . . [told] the Yoakum Lions Club (following introductions by Highway District Engineer M. G. Cornelius of Yoakum and Lion Joe Sutton, both of whom agreed that Texas could equal California and Florida with the aid of a little publicity)."

COME SPRING

Victoria Advocate, regarding Port Lavaca—"The opening and dedication of the new $4.5 million highway causeway over Lavaca Bay will not come until late 1961, although the giant bridge may be finished by mid-summer, highway officials estimated here last weekend.

"Building of two lengthy approaches on each side of the causeway—which will be Texas' longest bridge—will require 200 working days, starting in early spring, Resident Highway Engineer W. A. King, of Victoria said."

CONTEMPLATIONS

Uvalde Leader-News, speculating on future of Highway 90 from San Antonio to Del Rio—"[State Highway Engineer D. C.] Greer said that the proposed improvements will provide better access to the metropolitan area of San Antonio while serving as a better link in the total highway system."

Van Horn Advocate, contemplating the effect of proposed Interstate 10 loop—"D. C. Greer, State Highway Engineer, answered that although he did not want to be held accountable for a prediction the Department doesn't expect to be working on Interstate 10 around Van Horn for at least another five or six years.

"The by-pass loop will definitely hurt some, but if constructed in the near future it would be a real blow. But within five or six years or more, with traffic predicted to increase 10 to 15 per cent and more on the Interstate route, it is hoped that the local tourist and traffic business will be able to hold its own as usual."

IN GENERAL

Weekly Review (Athens), quoting Highway Commissioner Charles F. Hawn's appraisal of general warehouses—"For the past three years, this city has been the site of the first general warehouse built by the Highway Department under a new decentralization program to supply 'highway housekeeping' materials to districts through North, East, and Southeast Texas. . . . The original general warehouse proved so successful in serving the area that another warehouse was built alongside it.

"One of the permanent benefits of the warehouses, Hawn noted, is the economic boost they give to Athens.

". . . the annual savings made possible by the use of the regional warehouses sites . . . will be sufficient to eventually pay for the construction costs of the warehouses."

MULTI-MILLION DOLLAR PROPOSAL

Longview News, revealing that—"The Texas Highway Department is now in the process of preparing bid proposals for aerial photography on the multi-million dollar relocation of Highway 149 through Longview, Ralph Kutzer resident engineer of the Texas Highway Department said Monday.

". . . He said that start of construction on the project was possibly more than a year away."

WHEN THE NEED ARISES

Henderson Daily News, telling about a long-range plan—"Looking to the future, the Texas Highway Department is considering the possibility of requesting the cooperation of the Rusk County commissioners' court in securing a four-lane right-of-way when an anticipated demand for a north-south highway through Rusk County is sufficient to authorize such a highway, according to State Highway Engineer D. C. Greer."

RAINCHECK

Houston Post, relaying word from its Beaumont news service that instead of a January 1 opening—"Opening of the Interstate Highway 10 freeway between Beaumont and its junction with the Houston-Port Arthur Shortline in Winnie is being delayed because of excessive rains during November and December, W. E. Simmons, Beaumont district highway engineer, announced Friday."

RE-SIGNED

Big Spring Herald, datelined Austin—"The Highway Commission ordered Thursday a single state highway number—Texas 30—to replace all other numbers between Huntsville and College Station."

PRECONSTRUCTION SESSION

Galveston Tribune, announcing—"Plans on the operation of a road construction project, Farm Road 646 from State Highway 6 at Alta Loma southwest to the Galveston-Brazoria county line, will be revealed and discussed in a pre-construction meeting at 7:30 p.m. Wednesday at the fire station in Alta Loma.

"G. W. Callahan of Dickinson, senior resident engineer for the Texas Highway Department . . . will be present to outline the project. . . ."

HIGH AND MIGHTY

Dallas Times Herald, reporting—"Part of the inner freeway loop around Downtown Dallas will go into the sky, it was indicated Thursday by the State Highway Department.

"The J. Woodall Rodgers Freeway—formerly known as Cochran-Munger—will be elevated above cross-town traffic for its entire length from Stemmons Expressway to Central Expressway.

" 'We . . . believe that your proposal is an efficient and economic approach to this proposed project,' District Engineer B. L. De Berry wrote to City Hall Thursday."

NO MORE ICE on bridges ?

Electric energy is spearheading a determined assault against an old and deadly traffic hazard in Texas—iced-over bridges.

In the hope of permanently solving this age-old peril to motorists and exasperating winter maintenance problem, engineers of the Texas Highway Department are now experimenting with an electrical ice-prevention system in District 3 near Wichita Falls.

First of its kind ever undertaken in Texas, the research project is taking place on twin bridges of U. S. 287 at its intersection with City View Drive near the northwest city limits of Wichita Falls.

The anti-icing system, employing the use of electrical heating elements embedded in the concrete bridge slabs, may be the fruitful culmination of years of search by the Highway Department for a more efficient, neater, and less expensive method of keeping ice off bridges when the Lone Star State is in the grip of one of its infamous "wet northers."

Engineers hope that this extensive research project will provide the answers, although any full-scale application of the information obtained may be a few years away.

The headache of iced-over bridges has been particularly acute in Texas, where flash freezes occur periodically during the winter months. Ice forms more easily on bridges than on highways because cold air circulates both above and below them. Temperatures of the adjacent highway areas are reduced more slowly, and may not reach the freezing point at all, due to contact with heat radiated from the earth.

This creates a deceptively dangerous situation for the winter motorist, who may be driving comfortably at 60 miles an hour along an unfrozen highway and suddenly come upon a glazed-over bridge. The result: disaster.

Traditionally, sand and salt have been the standbys used by Department maintenance crews to fight the icing process. This has often involved feverish all-night work in anticipation of flash freezes after a routine check with the U. S. Weather Bureau. It is hoped that the new approach may eventually free hard-pressed maintenance crews from these disagreeable midnight labors.

The search for an anti-icing procedure that would eliminate the necessity for men to spend the early hours of the morning shoveling sand and salt has been going on for years. Among the ideas considered earlier by the Department was a hydraulic system that would circulate a heated liquid — probably water — through pipes built into bridge slabs. This system was cast off due to foreseeable problems of protecting the liquid from freezing (by use of antifreeze), building a power unit large enough to heat the liquid, and the complicated and constant maintenance that would likely be necessary to keep it in efficient operation at critical times.

Electric energy was chosen as the medium for this experiment because it can attain a high percentage of efficiency with no heat loss as would be the case with natural gas or other

Pictured is one of the two bridges at the intersection of U.S. 287 and City View Drive near Wichita Falls, in which the experimental anti-icing units were installed. In the initial stage of construction here, the deck form awaits placement of reinforcing steel.

power-producing fuels.

The idea is not entirely new. A few bridges of this type have been used on heavily traveled highways near Detroit, New York, and Chicago but no such experiment has previously been carried out anywhere in the South.

The Wichita Falls area was chosen as the site of the experiment since it is a location particularly susceptible to flash freezes, which provide good test conditions for the project. The anti-icing system has been built into the bridges during their regular construction stages, and is so designed that it does not affect the bridge structures. If the heating system proves unfeasible, the bridges can still be used in normal fashion and the only expense incurred by the Highway Department will be the nominal amount needed to finance the research.

The anti-icing system will not affect the bridges from a safety standpoint. It will be impossible for a pedestrian to be burned or shocked on the bridges. The tops of the bridge slabs will be only slightly above the freezing mark—perhaps 33 degrees—at their warmest points. "You won't be able to warm your feet on it," commented one engineer wryly. The bridges are also completely grounded, eliminating the possibility of electric shock.

The object of the research to be conducted this winter, and in succeeding winters if necessary, is to determine the most efficient design and operation of the system. Toward this end, engineers from District 3 and from the Highway Design Division in the Austin office have cooperated during the installation of the system. The Materials and Tests Division has cooperated in the development of instrumentation for the study.

A Departmental research project, the program has the approval of the Research and Development Committee of the Texas Highway Department. It is a regular federal-aid proj-

ect jointly financed by the Highway Department and the Bureau of Public Roads. It is designated Federal Project Numbers F119(11) and U119(12).

Basically, the anti-icing system is composed of conduits containing electric heating cables which are connected to a master control panel.

To guarantee the permanent location and physical protection of the heating cable, electric metallic tubing was used. This tubing is of galvanized steel treated both inside and out for full protection. These conduits were placed in the bridge decks at different levels. One set of conduits was placed in a grid arrangement on top of the reinforcing steel mat and tied to it to maintain proper alignment during the placement of concrete in late November. On this bridge, the conduit is one inch below the roadway surface.

On the other bridge, the conduit was tied to the underside of the reinforcing steel mat, resulting in a three-inch "bury" underneath the covering of concrete.

Conduits are spaced at intervals of six inches, eight inches, and twelve inches to allow different test conditions. In addition, the system is so constructed that the operators will be able to turn every other conduit off, allowing them to test spacings of twelve, sixteen, and twenty-four inches. The electric energy can be varied from five watts per square foot to twenty watts.

The tubing was used to provide a permanent void through which the heating cables could be placed. This will ease the problem of cable maintenance. If a cable must be repaired or replaced, it can simply be pulled out from the tubing.

The heating wire chosen was solid nickel-chromium alloy. It is wrapped in glass yarn and insulated with silicone rubber, and further protected by its outer shield of tinned copper braid. When the design voltage is applied, its output will be ten watts per linear foot. Each linear foot of wire will produce slightly more than 34 British thermal units per hour.

A reinforcing steel mat is placed. Conduit for the anti-icing system was later placed on the steel and tied to it to guarantee permanent location of the heating cable.

Conduit is placed by sections. In the background, a section is almost complete; foreground—tubing awaiting placement on the reinforcing steel mat.

All conduit ends in a galvanized iron wire duct installed on each bridge. The wire duct, enclosed by a removable weatherproof cover, leads to the control panel.

The cabinets containing the control panels were mounted between bridge columns beneath each structure, near ground level to protect them from atmospheric conditions. The weather-

At left center a workman bends over the galvanized iron wire duct in which all conduit ends. The wire duct runs the length of one side of the bridge and is connected to a control panel placed beneath the structure.

proof gray iron enclosures feature interlocking double doors which latch and lock. The backboards are of three-quarter-inch fir plywood treated with a dark oil stain on both sides.

Each panel contains:

1. A disconnect switch.
2. Magnetic switches which are 600 volt, three-phase, bimetal overload relays.
3. Selector switches of the single-pole, toggle-action type.
4. A control switch with three positions marked manual, off, and automatic.
5. Ambient-compensated thermostats using a remote bulb to detect and respond to temperature changes, measured at the remote bulb only.

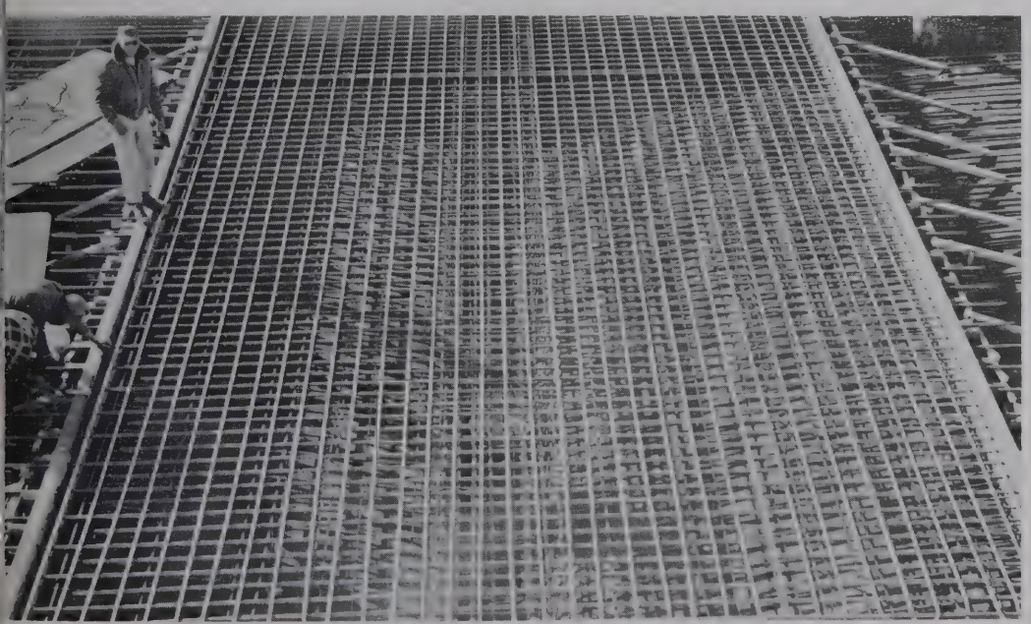
The power system is a three-phase delta of 480 volts.

Heat-sensing elements are also embedded in the bridge slabs and a recording thermometer will measure slab temperature at different points enabling engineers to determine how fast heat diffuses through the concrete and how long it takes to warm the slab to the above-freezing point under various controlled conditions.

The installation of the electric equipment was finished in mid-January. Testing was to begin with the first wet norther thereafter which would furnish needed test conditions.

It is hoped that the system will maintain the roadway surface of the bridges above the freezing mark with air temperatures as low as expected.

District 3 maintenance crews, depending for years on the weather forecaster in their never-ending sanding and salting operations on existing bridges, still must rely on the same source of information in operating the anti-icing system. The semiautomatic control panel's thermostats will turn it on and shut it off as the temperature changes, but at present there is no humidity control. The weatherman is still the most reliable source to warn of an approaching norther which is expected to combine freezing temperatures and moisture. When one of these fronts blows in, the anti-icing unit must be turned on manually. Future research will probably result in the development of a satisfactory humidity-sensing device which will overcome this problem.



Over-all view of a section of conduit, looking across the bridge.

Conduit is in place ready to receive its protective covering of concrete. In background is a screed used in leveling the concrete. »

The pouring of concrete took place in November. In the foreground is a vibrator used to consolidate the concrete.

The length of time needed to fully test the anti-icing units, and to glean all the needed test data to determine the ideal mode of operation, is at present unknown. The progress of the project depends on the vagaries of Texas winter weather, but it might take up to five years before all the answers are known about the system.

Among the important questions for which engineers seek answers will be the cost of operation of the unit, which will draw its energy from electric utility systems.

If the anti-icing unit proves successful at the end of its rigorous testing period, it might eventually be built into new bridges constructed in many sections of Texas. Although details are not perfected, adaption of its use on existing bridges also appears to be feasible, but engineers say they will "cross that bridge when we come to it"—no pun intended.

THE RECAP STORY

John B. Nations, Director
Equipment and Procurement

Three years of concerted effort by the Highway Department in Equipment Preventive Maintenance's recapping program have produced good results.

In January of 1958, Equipment and Procurement Division decided that at least 40 per cent of all replacement tires used on equipment must be recaps. Although this figure approximated the national average, it seemed high to many of the Districts, since this literally meant that four of every ten tires replaced would be recaps.

Outstanding work on the part of everyone in these twelve Districts—District Engineers, Maintenance Engineers, Maintenance Superintendents, Auditors, Equipment Supervisors, Warehouse Superintendents, Maintenance Foremen, and Equipment Operators—is responsible for this fine showing.

Here's how: San Antonio jumped from 40 per cent last year to 122 per cent in 1960; with 846 tires recapped against 694 new ones purchased; Paris increased from a high 93 per cent last year to 107 per cent this year, recapping 424 tires compared to 395 new ones purchased; El Paso moved up from 55 per cent to 83 per cent; Tyler from 58 per cent to 74 per cent; Amarillo from 45 per cent to 62 per cent; Dallas from 40 per cent to 60 per cent; Bryan from 28 per cent to 45 per cent, and San Angelo from 18 per cent to 40 per cent.

In just three years the District state-wide average has jumped from 16 to 45 per cent recaps against new tires. Averaging 67 per cent are the top twelve Districts, listed below, which have a net of slightly over 40 per cent total replacement tires being recaps.

District 15, San Antonio	***122%***
District 1, Paris	***107%***
District 24, El Paso	***83%***
District 10, Tyler	***74%***
District 4, Amarillo	***62%***
District 18, Dallas	***60%***
District 20, Beaumont	***54%***
District 19, Atlanta	***47%***
District 23, Brownwood	***47%***
District 17, Bryan	***47%***
District 11, Lufkin	***42%***
District 7, San Angelo	***40%***

Not only recapping, but costs, too, are of major interest and concern to the Districts, as evidenced by a question asked last summer. "How much," asked the District Equipment Supervisor, "has your work and meetings in D-4 helped reduce equipment costs; what has been accomplished?" Here's the answer.

Three years ago, D-4 advised the

Districts that since 1955 new-tire costs had increased at the rate of $75,000 annually. By 1957, the cost exceeded one-half million dollars. To cut rising costs, D-4 personnel outlined the necessity for improved tire preventive maintenance practices, including the recapping of all truck and grader tires possible. With whole-hearted cooperation from the Districts, results were notable. To wit:

In 1957, with 9,892 units of major equipment in service, the Districts purchased 18,000 new tires and had 1,500 tires recapped—a total of 19,500 replacements. Average: 1.97 tires per unit.

Last year, with 12,328 units in use, purchases ran 12,885 new tires against 5,746 recaps—or 18,632 replacements. This averages to 1.51 tires per unit, a reduction of approximately one-half tire per unit over 1957.

There are many ways to project an expectancy on total savings for a three-year period. One would be to take the annual average increase for 1955-56-57-58 ($75,000), 1959 ($150,000), and 1960 ($225,000), totaling $450,000. Subtracting from this figure the combined cumulative total increase in new tire and recapping purchases for the three-year period leaves a net of $300,000 gross potential savings realized since the start of our tire preventive maintenance program.

Perhaps the simplest and fairest method, however, would be to figure the 1.97 tires per unit purchased in 1957 against the 12,328 pieces of major equipment operating in 1960. Considering the 24,286 tires at the average price of $31, this is a value of some $752,870.96. Since the combined new and recapped tire purchases for 1960 amounted to only $556,530.51, we subtract this amount from the projected figure above and derive $196,340.45 as our 1960 net savings.

To summarize, in 1960, with 12,328 units of major equipment operating, the 25 Districts used 12,885 new tires and 5,746 recapped tires—a total of 18,632 replacements, averaging 1.51 tires per unit.

The 1960 replacement reflects the improvement in all phases of District preventive maintenance, with a reduction of .46 tires per unit—almost one-half tire per unit. Contributing factors have been the "intangibles"—closer attention to tire inflation, rotation, dual mating, and loads carried. Within a three-year period, approximately 1,000 fewer tires annually are being replaced, despite the fact that there are more than 2,000 additional units and 12,000 extra tires in use than in 1957. Normally, about one-third (or 4,000) of these tires would need replacing annually.

Improved lubrication practices and equipment inspection procedures are beginning to show results in the form of lowered operating costs for many of the Districts. Listed below are statewide averages on five categories from D-4's annual Equipment Preventive Maintenance of major equipment report:

repairs and parts per unit... $202
depreciation per unit..... $418
purchase of recaps per unit.. .475
purchase of new tires per unit 1.065
purchase of batteries per unit .508

To determine your outlay for 1960, multiply the above figure by the number of units in your District.

Since the amount of new equipment on hand determines the depreciation loss and the amount of older equipment increases the repair and parts cost, some Equipment Supervisors add these two figures together to reach the average cost per unit (excluding fuel and other direct costs). In adding item one and two, the total—$620—represents the average amount spent by Districts on repairs, parts, and depreciation per unit. Based on this figure, the following Districts are doing an excellent job on equipment preventive maintenance.

District 1, Paris $500
District 3, Wichita Falls ... 483
District 4, Amarillo 525
District 6, Odessa 512
District 16, Corpus Christi .. 500
District 18, Dallas 395
District 23, Brownwood 408
District 24, El Paso 393

As the accompanying report indicates, some Districts have not yet whipped all tire and equipment preventive maintenance problems. However, the wheels are working, and while some Districts have reached an early peak, the others have improved tremendously since 1958. With a little more effort, they too can climb into the 40 per cent bracket.

OVER THE HIGHWAYS

Comments . . . from the Traveling Public

• I want to congratulate you and the maintenance crew on doing an outstanding job during the recent snow.

During the snow I made a trip to Olton and the section of highway in Hale County was in excellent condition. I want you to know that the traveling public appreciates the fine work of your department.

Charlie R. Young, General Manager
Plainview Chamber of Commerce

• As one who has been over many Texas highways during the years, I am somewhat immune to the scenery, and quite often do not appreciate to the fullest the intense effort made by some to make our highways safe and beautiful.

As I returned from the coast this week, however, I noticed a strip of highway that to me was so outstanding that I felt I should compliment you on it. Perhaps you would like to pass this compliment on to the appropriate person. The highway was U. S. 183 in DeWitt County. Not only was the roadbed good and well preserved, but the shoulders were scraped and the freeway mowed and well kept. My wife and I then noticed that the trees were trimmed and that there were spots where piles of brush had been collected. The bridges were well painted and in general all evidences of good housekeeping of our highways seemed to be present.

I am sure that there are many other counties or districts in Texas that have as fine a personnel as this one, but I could not help but call your attention to the fact that this stretch of U. S. 183 impressed me a great deal.

B. H. Amstead
Assistant Dean of Engineering
The University of Texas

• We would like to express our sincere appreciation of the excellent cooperation of your men in the cities of Benjamin, Guthrie and Dickens, Texas, through this belated letter.

In December of 1960, during the cold weather and iced highways between these cities, your men assisted several of our drivers by assisting them up some of the hills in these sections. Our drivers informed us that any time they are in need of help, they can always depend on the prompt and perfect cooperation from anyone connected with your department. We have found this to be true in every part of Texas.

Johnnie L. Croft,
Safety Division
Illinois-California Express
Amarillo, Texas

• We liked everything and everyone—the friendly, courteous, helpful people, interesting San Antonio sights, magnificent scenery, and your Travel Map giving points of interest. We would have missed so much without it. Your roads are good. We had a flat and everyone stopped to help. Your drivers are real cowboys, though, and cut in from side roads too close.

Nanette Lodge
Miami Beach, Florida

• Thanks for the maps and enclosures, I'll be able to solve my problem. Thanks to what I consider the best operated department in our state government.

Otto J. Keefer
Galveston, Texas

• This letter has been long delayed because the memorandum I made at the time was lost and I recently found it.

On July 5, I was returning from Monterrey, Mexico, with my family when my car developed some trouble about ten miles north of Laredo at a spot where there was just nobody who could help me, except one of your crews which was putting some additional covering on the roof of a wayside shed.

These men were most cooperative, gave us a lift to where we could get some water which we desperately needed and insistently refused to accept any kind of tip for their trouble.

I think you should know about this and I am listing below the names of the men in this group:

Benigno H. Rodriquez
Fidencio Ahira
Frank M. Newsome

Adolph K. Scharff
Executive Vice President
Lewis Investment Company
Kansas City, Missouri

To and From Our Readers

Urban Designing Engineer William V. Ward, Houston, was recipient of the first award given a Texas engineer by the Prestressed Concrete Manufacturers Association of Texas. He was recognized for his design and use of prestressed concrete in bridge construction in the Gulf Coast area.

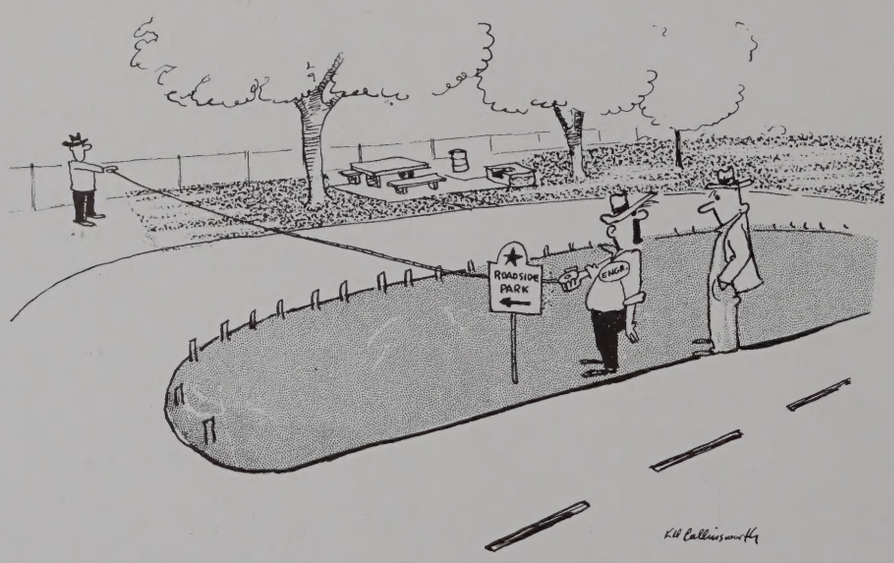
The same award for outstanding design use of prestressed concrete for a bridge in the Central Texas area was later given to Travis Long by the Association. Long is Supervising Resident Engineer—Expressway—in the Austin District Office.

Senior Resident Engineer Tom R. Rideout, of Marshall, was presented with one of Scouting's highest honors —the Silver Beaver award—at the annual banquet meeting of the East Texas Area Council in Greggton in December.

Symbolizing outstanding and exceptional service to boyhood, the award is the highest one obtainable from a local council by an adult volunteer. In token of the honor, Rideout received a certificate and a silver medal of a beaver. The medal, which is about the size of a half dollar, is worn on special Scouting occasions.

The annual Highway Short Course at A. & M. College gets underway March 7 in College Station, and goes through March 9. A District Engineers' Meeting will be held Monday, March 6, at 10 a.m. First half day of the Short Course will be devoted to a General Session.

Attending the conference — the thirty-fifth such — will be personnel from both the Austin Office and the Districts.



"WERE TRYING TO FIND OUT HOW WIDE TO MAKE THE NORTH-BOUND LANE."

About Our Pictures . . .

This month's cover picture was made on U. S. 69, two miles north of Jacksonville. Purpose of the pipes is explained in our lead story, page 2 —"Concrete Pipe Installed by Imperfect Trench Method."

The scenic section of U. S. 77 pictured inside the front cover winds down from Monument Hill toward La Grange.

No, that's not an Interstate Route pictured inside the back cover, but it has its place. The cool, inviting road is in Caddo Lake State Park.

TEXAS HIGHWAY COMMISSION

HERBERT C. PETRY JR.	**Chairman**
CHARLES F. HAWN	**Member**
HAL WOODWARD	**Member**
D. C. GREER	**State Highway Engineer**

Texas Highways

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